

Correlations of Parturition Body Temperature and Postpartum Fever of Sows with Vulvovaginal Discharge: a Case Report

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Received August 16, 2004

Accepted June 6, 2005

Abstract

Franek S. P., G. Bilkei: Correlations of Parturition Body Temperature and Postpartum Fever of Sows with Vulvovaginal Discharge: a case report. Acta Vet Brno 2005, 74: 2005: 395-399.

In a large pig breeding unit, sows suffering from parturition vulvovaginal discharge were selected ($n = 159$) for the trial. Rectal temperatures were recorded daily on days 110-113 of pregnancy and during the first 3 days post partum. Fifty-two sows (group one) had higher than $39.0\text{ }^{\circ}\text{C}$ ($39.3 \pm 0.3\text{ SE }^{\circ}\text{C}$), 107 sows (group two) had lower than $39.0\text{ }^{\circ}\text{C}$ ($38.6 \pm 0.2\text{ SE }^{\circ}\text{C}$) "three days average prepartal rectal temperatures". While all sows in group one developed postparturient fever ($40.5 \pm 0.2\text{ SE }^{\circ}\text{C}$), only 19 of 107 (17.8%) sows with lower parturition temperatures had postparturient fever ($P < 0.001$).

Blood samples were collected on days 1, 3 and 5 post partum to determine the concentration of acute phase proteins. Mean serum alpha 1-acid glycoproteins (AGP) and haptoglobin (HPT) concentrations were higher on days 1, 3 and 5 ($P < 0.001$) post partum in sows suffering postparturient fever.

Our results have shown that in farrowing units with high prevalence of parturition vulvovaginal discharges, preparturition rectal temperatures might indicate impending postparturient disease of the sow.

Swine, sow, parturition, parturition body temperature, postpartum fever vulvovaginal discharge

The reproductive performance of the breeding sow is a key measure in the pig production. While many factors influence the profitability of swine production, the number of piglets produced per sow per year (Pig/Sow/Year, PSY) and number of non-productive days (NPD) belong to the most important measures of productivity (Stelzer et al. 1997). Both PSY and NPD are significantly influenced by postparturient diseases of the sows (Akos and Bilkei 2004). Lactation failure and early postpartal diseases of sows belong to major causes of sow mortality and low reproductive performance in pig breeding units (Karg and Bilkei 2002).

The stress due to preparturition dislocation and farrowing might activate subclinically present chronic urogenital infections (Sanders and Bilkei 2004), resulting in postparturient disease of the sow (Waller et al. 2002).

In pigs, serum acute phase protein (APP) levels are influenced by infectious processes (Burger et al. 1992). Swine urogenital disease (SUGD) and mastitis-metritis-agalactia syndrome (MMA) (Waller et al. 2002) cause elevated APP levels and may contribute to inferior litter size, inadequate lactation performance, lower farrowing rate, abortion, and sow mortality (Bilkei 1995; Mirko and Bilkei 2004). High alpha 1-acid glycoproteins (AGP) serum levels may negatively influence the pharmacological effects of antimicrobial drugs (Son et al. 1996). Haptoglobin (HPT), AGP, and C-reactive protein (CRP) are the mainly studied serum APPs in swine (Hall et al. 1992).

In the present study the hypothesis was to prove if prepartal urogenital infections accompanied by elevated rectal temperature might be associated with postpartum pyrexia of the sow.

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Materials and Methods

The trial was performed from January till August 2004 in a large Hungarian pig breeding unit of 2 000 sows with high incidence (> 38% of farrowings) of postparturient diseases. The sows were F1 crosses of Landrace and Large White and were mated to Duroc boars. Parity distribution of the trial animals was 4.9 ± 1.1 SE, average body condition score (Bilkei and Bölcskei 1993) was 3.4 ± 0.3 SE during the trial period. The sows were artificially inseminated (AI) twice within 16 - 30 hours following standing heat. Repeat breeders were AI at their first return to estrus. Pre- and postpartal and postweaning vulvovaginal discharges were often (> 30% of the inventoried females) recorded in this unit.

The sows received erysipelas, pseudorabies, *E. coli* (F4, F5, F41) and leptospirosis vaccination during their pregnancy and parvovirus vaccination during lactation. During the trial (proven by serology, Vet Invest Zagreb, Croatia) other endemic reproductive diseases (encephalomyocarditis, brucellosis), or infectious diseases (actinobacillosis, listeriosis), porcine reproductive and respiratory syndrome (PRRS), commonly thought to be possible reproductive pathogens and often associated with infectious reproductive problems, were not diagnosed in the unit. The sows were kept during gestation in individual crates and were moved on day 109 of pregnancy to the farrowing facilities. For five days before parturition the sows received *ad libitum* a "farrowing diet", approximately 4 kg/sow/day, containing 12% fibre, supplemented with 50% higher vitamin content than recommended in the NCR, USA 1988 (NCR 1988). No hormonal peripartal biotechnique was performed. During lactation the sows were fed *ad libitum*.

Sows diagnosed with postparturient fever (> 39.5 °C) were treated with an Enrofloxacin (Baytril® Bayer, Germany, 3 mg/kg body weight) antibiotic intrauterine infusion [according to sensitivity test], three days of parenteral antibiotics [according to sensitivity test] and oxytocin [10 IU/day, Oxytocin® TAD, Germany], and on day of positive diagnosis for MMA one prostaglandin F2 α injection [175 μ g cloprostenol, Estrumate® Essex, Germany]).

Rectal temperatures (with calibrated electronic thermometer, Provet, Lyssach, Switzerland) of the sows were recorded on days 110 - 113 of pregnancy and during the first 3 days post partum.

Blood samples were collected (from the coccygeal artery or vein) into heparinised tubes (Becton Dickinson, Budapest, Hungary) on days 1, 3 and 5 post partum for the estimation of the concentration of acute phase proteins. The blood samples were centrifuged within 2 hours of collection at 2200 g for 10 minutes at 4 °C, and the plasma was separated and stored at -20 °C until it was analysed.

ELISA serum AGP and HPT were performed according to ESAP (as described by Laboratory procedures were performed in Vet Invest (Zagreb, Croatia) assays (or Son et al. 1996 and Grellner et al. 2002).

The data were entered into Microsoft access database and analysed statistically using statistical analytical system (SAS 1997) version 8.01 and SPSS computer programs. The results, i.e. body temperatures, average parity and body condition scores are presented as means (SE), other evaluated parameters as means and standard deviation (SD) and significance was accepted at $P < 0.05$. The sows rectal temperatures were compared between days post partum by analysis of variance and between normal sows and sows with prolonged duration of parturition (> 5 h) by using t tests. The categories of normal temperature and fever were determined by using the 75% quartile as the cut of point for the maximum temperature recorded. Body condition scores and parity were compared between the pyrexia and healthy animals by the Mann-Whitney U non-parametric test.

The concentrations of APP's and postparturient fever were analysed by analysis of variance for repeated measurements, using a mixed model of SAS (1997). The data were examined for normality by using the Kolmogorov-Smirnoff test and for equality of variance by Levene's test. Where appropriate, the data were log 10 transformed, to give homogeneity of variance.

Results

Fifty-two sows (group one) had higher than 39.0 °C (39.3 ± 0.3 SE °C), 107 sows (group two) had lower than 39.0 °C (38.6 ± 0.2 SE °C) "three days average prepartum rectal temperatures". The highest average body temperatures were measured on day 2 post partum.

While all sows in group one developed postparturient fever (average 40.5 ± 0.2 SE °C), only 19 of 107 (17.8%) sows with lower prepartum temperatures had postparturient fever (average 40.6 ± 0.3 SE °C), ($P < 0.001$). Forty sows in group one (75%) with postparturient fever had longer than 4 h duration of parturition. Parity distribution in group 1 was 5.4 ± 1.2 SE (group 2: 4.4 ± 1.4 SE, $P < 0.05$ compared to group 1) and average body condition score was 3.8 ± 0.4 SE (group 2: 3.1 ± 1.3 SE, $P < 0.05$ compared to group 1).

Mean serum alpha 1-acid glycoproteins (AGP) and haptoglobin (HPT) concentrations were higher at days 1, 3 and 5 ($P < 0.001$) post partum in sows suffering postparturient fever (Table 1 and 2).

Table 1. Alpha 1-acid glycoproteins (AGP) serum values in postparturient sows

Evaluation at	Healthy µg/ml (± SD)	suffering from postparturient fever µg/ml (± SD)	<i>P</i> -value
One day after parturition	611.4 ± 89.2	996.9 ± 109.9	< 0.001
Three days after parturition	701.2 ± 81.2	1099.7 ± 111.2	< 0.001
Five days after parturition	799.2 ± 100.3	1028.5 ± 102.1	< 0.001

Table 2. Haptoglobin (HPT) serum values* in postparturient sows

Evaluation at	Healthy mg/dl (± SD)	suffering from postparturient fever mg/dl (± SD)	<i>P</i> -value
One day after parturition	1.09 ± 0.2	29.22 ± 3.6	< 0.001
Three days after parturition	3.22 ± 0.2	29.33 ± 3.1	< 0.001
Five days after parturition	2.73 ± 3.4	27.79 ± 4.3	< 0.001

* Haptoglobin concentrations are given according to the authors experiences

Discussion

In the present study, the average rectal temperatures of the sows were good indicators for postparturient diseases. Consistent with Bilkei and Horn (1991) the present results indicate, that in units with high prevalence of preparturient vulvovaginal discharges, the elevated preparturient rectal temperatures might be practicable indicators for impending postparturient disease of the sow. It is reasonable to suggest that in the present study, the subclinically present chronic urinary tract infection (UTI) has activated a postparturient febrile disease due to the stress of parturition. Parity distribution and average body condition might have contributed to the present results (Bilkei et al. 1995).

In the present study, sows suffering from postparturient fever had higher AGP and HPT serum concentrations. These findings confirm those of Horadagoda et al. (1999) and Mirko and Bilkei (2004) who stated that in acute inflammatory diseases the serum levels of APP's increase. While there are numerous publications on haematological and blood chemical data on sows suffering from prepartal vulvovaginal discharge and developing subsequent postparturient MMA/SUGD (Bilkei 1995), there are scarce published data on serum AGP, and HTP in such animals (Mirko and Bilkei 2004). Febrile postparturient diseases of the sow are acute inflammatory processes. APP's are useful to identify animals with acute inflammatory conditions, but are less specific in chronic infections (Mirko and Bilkei 2004).

Urinary tract infection (UTI) and swine urogenital disease (SUGD) are often found in combination with the mastitis-metritis-agalactia syndrome (MMA) (Waller et al. 2002; Mauch and Bilkei 2004). Vulval discharge is often associated with SUGD (Waller et al. 2002; Mauch and Bilkei 2004). Sows with UTI have a higher prevalence of postparturient fever, MMA/SUGD than sows with normal urinary tracts (Bilkei et al. 1995).

According to Itoh et al. (1993) the upper normal limit of serum AGP is around 500 µg per ml for young growing swine. Itoh et al. (1993) found that serum AGP increases in response to infections and concluded that a sudden increase in serum AGP may be associated with acute rather than chronic infections. MMA/SUGD is an acute disease, affecting the sow within hours post partum. Thus, an increase in serum AGP concentrations may be considered as an indicator of intracellular immune communication, indicating an increase of cellular immune response (French 1989) post partum. The increase in HPT serum concentrations

in the present study are similar to the findings of Grellner et al. (2002) who evaluated growing pigs raised under high *Mycoplasma hyopneumoniae* environmental pressure. The present findings indicate that the sows suffered from a long lasting stress due to MMA/SUGD that influenced their immune system.

Similar to the present findings, in a shortly published study (Mirko and Bilkei 2004) serum concentrations of APP, HPT, AGP, and cortisol, in sows with postparturient MMA and in healthy sows were evaluated and their reproductive performance recorded. Total born pigs, live born pigs, stillborn pigs, and number of mummified pigs did not differ significantly between the groups. However, preweaning mortality showed significant ($P < 0.001$) differences between the MMA suffering ($22.1 \pm 5.2\%$) and healthy sows ($12.6 \pm 2.1\%$). Four weeks weaning litter weights differed significantly ($P < 0.01$) between the MMA suffering and healthy animals (68.2 ± 2.1 kg vs. 77.3 ± 3.2 kg). In this study (Mirko and Bilkei 2004) mean serum AGP concentrations were higher ($P < 0.001$) at day ten and twenty ($P = 0.02$) after parturition in MMA suffering sows, showing the negative effect of postparturient MMA and accompanied serum changes on the reproductive performance of the sows. Mean serum HPT was higher in MMA suffering sows at Days 1,5 ($P < 0.001$) and 10 ($P = 0.04$) of lactation. Serum cortisol concentrations were significantly ($P < 0.001$) higher throughout the study in MMA-suffering sows compared to the healthy ones. AGP was negatively correlated with litter weights, indicating that an activation of cellular immune response of the sow negatively effects growth rate of her litter. Correlations were found on the overall means for weight, acute phase proteins and serum cortisol. The authors (Mirko and Bilkei 2004) concluded that AGP negatively correlates with litter weight, indicating that an activation of cellular immune response of the sow negatively effects growth rate of the suckling piglets and that HTP may be a valuable indicator of stress and disease in postparturient sows.

The mechanism for increasing body temperatures involves coordinated autonomic, neuroendocrine and behavioural responses to inflammatory conditions. Fever occurs in response to the detection of interleukins (IL-1 and IL-2) and tumour necrosis factor-alpha (TNF alpha) by receptors of the brain. These stimulate a coordinated neural response in the hypothalamus and brainstem to reset the thermostatic set point for body temperature. The secretion of APP's by the hepatocytes is also stimulated by the increased plasma concentrations of IL-1 and IL-2 and TNF alpha and is associated with bacterial infections.

Vztah mezi prepartální rektální teplotou těla a postpartální horečkou prasnic s vulvovaginálním výtokem: kasuistika

Pro pokus byly z velké porodny prasat vybrány prasnice s prepartálním vulvovaginálním výtokem ($n = 159$). Těmto prasnicím byla během 110.-113. dne březosti a během prvních 3 dní post partum denně měřena rektální teplota. Průměrná třídní prepartální rektální teplota byla u 52 prasnic (skupina 1) vyšší než $39,0$ °C ($39,3 \pm 0,3$ °C) a 107 prasnic (skupina 2) ji mělo nižší než $39,0$ °C ($38,6 \pm 0,2$ °C). Zatímco u všech prasnic ze skupiny 1 se objevila postpartální horečka ($40,5 \pm 0,2$ °C), u skupiny s nižší prepartální teplotou se postpartální horečka objevila pouze u 19 ze 107 prasnic ($P < 0,001$).

V 1., 3. a 5. dnu po porodu byly odebrány vzorky krve a určena koncentrace proteinů akutní fáze. U prasnic trpících postpartální horečkou byla 1., 3. a 5. den vyšší koncentrace sérového glykoproteinu AGP a haptoglobinu (HPT) ($P < 0,001$).

Výsledky studie ukázaly, že v porodnách prasat s vysokou prevalencí prepartálních vulvovaginálních výtoků mohou zvýšené prepartální rektální teploty prasnic signalizovat hrozící postpartální onemocnění.

References

- AKOS K, BILKEI G 2004: Comparison of the reproductive performance of sows kept outdoors in Croatia with that of sows kept indoors. *Livest Prod Sci* **85**: 293-298
- BILKEI G 1995: Herd health strategy for improving the reproductive performance of pigs. *Hung Vet Journal* **10**: 766-768
- BILKEI G, BÖLCSKEI A 1993: Die Auswirkung der Fütterung im letzten Trächtigkeitsmonat auf die perinatalen Parameter bei verschiedener Körperkondition und Parität der Muttersauen. *Tierärztl Umschau* **48**: 629-635
- BILKEI G, HORN A 1991: Beitrag zur Therapie des Metritis-, Mastitis-, Agalaktie (MMA) Komplexes der Schweine. *Berl Münch Tierärztl Wschr* **104**: 421-423
- BILKEI G, BÖLCSKEI A, CLAVADETSCHER E 1995: Der Einfluss verschiedener praxisreifer zootechnischer Massnahmen auf das Auftreten des MMA - Komplexes. *Prakt Tierarzt* **1**: 42-50
- BURGER W, FENNERT EM, POHLE M, WESENMEIER H 1992: C-Reactive Protein-a characteristic feature of health control in swine. *J Vet Med A* **39**: 635-638
- FRENCH T 1989: Acute phase proteins. In: French, *The Clinical Chemistry of Laboratory Animals*. 1st ed. New York, Pergamon Press Inc. pp. 201-235
- GRELLNER GF, FANGMAN TJ, CAROLL JA 2002: Using serology in combination with acute phase proteins and cortisol to determine stress and immune function of early weaned pigs. *J Swine Health Prod* **10**: 199-204
- HALL WF, EUREL TE, HANSON RD, HERR LG 1992: Serum haptoglobin concentration in swine naturally or experimentally infected with *Actinobacillus pleuropneumoniae*. *J Am Vet Med Ass* **201**: 1730-1733
- HORADAGODA NU, KNOX KMG, GIBBS HA, REID SWJ, HORADAGODA A, EDWARDS SER, ECKERSALL PD 1999: Acute phase proteins in cattle: discrimination between acute and chronic inflammation. *Vet Rec* **144**: 437-441
- ITOH H, TAMURA K, IZUMI M, MOTOI Y, KIDOGUCHI K, FUNAYAMA Y 1993: The influence of age and health status on the serum alpha 1-acid glycoprotein level of conventional and specific pathogen free pigs. *Can J Vet Res* **57**: 74-78
- KARG H, BILKEI G 2002: Causes of sow mortality in Hungarian indoor and outdoor pig production units. *Berl Münch Tierärztl Wschr* **115**: 366-368
- MAUCH C, BILKEI G 2004: The influence of prepartal bacteriuria on the reproductive performance of the sow. *Dtsch Tierärztl Wschr* **111**: 166-172
- MIRKO CP, BILKEI G. 2004: Acute phase proteins, serum cortisol and preweaning litter performance in sows suffering from periparturient disease. *Acta Vet Beograd* **54**: 153-161
- NCR 1988: Nutrient requirements of swine, 9th ed. Washington, DC. National Academy Press.
- SANDERS LMG, BILKEI G 2004: Urogenital diseases and their effect on reproductive performance in high-parity sows. *Tijdschrift voor Diergeneeskunde* **129**: 108-112
- SAS Statview 1997. Statistical Analysis System Institute. 2nd ed. Cary, N. C. USA.
- SON DS, HARIYA S, SHIMODA M, KOKUE E 1996: Contributions of alpha 1-acid glycoproteins to plasma binding of some basic antimicrobials in pigs. *J Vet Pharmacol Ther* **19**: 176-183
- STELZER P, BILKEI G, CLAVADETSCHER E, BIRO O, TAKACS T, KOTAI I, BILKEI H 1997: Scheidenausfluss ante partum als Risikofaktor für postpartale Erkrankungen der Sau und frühpostnatale Ferkelverluste. *Berl Münch Tierärztl Wschr* **110**: 320-323
- WALLER CM, BILKEI G, CAMERON RDA 2002: Effect of periparturient disease and/or reproductive failure accompanied by excessive vulval discharge and weaning to mating interval on sow reproductive performance. *Aust Vet J* **80** : 545-549